WAIPAHU ESTATES UNIT 3-1 - PRELIMINARY SOIL REPORT

WAIPIO, EWA, OAHU, HAWAII
TAX MAP KEY: 9-4-07: 11 & 24

To:
COMMUNITY PLANNING, INCORPORATED

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

OCTOBER 11, 1971

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

WALTER LUM
EDWARD WATANABE
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3030 WAIALAE AVE., HONOLULU, HAWAII 96816 • TEL. 737-7931

October 11, 1971

MR. GEORGE HOUGHTAILING
Community Planning, Inc.
Suite 608, 700 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Houghtailing:

Subject: Waipahu Estates Unit 3-1
Preliminary Soil Report
(for residential development)
Waipio, Ewa, Oahu, Hawaii
Tax Map Key: 9-4-07: 11 & 24

In accordance with your request, soil explorations were made to determine general soil conditions at the proposed residential development site for Waipahu Estates Unit 3-1 at Waipio, Ewa, Oahu, Hawaii.

The surface soils at the site may be generally described as stiff reddish-brown clayey silts and silty clays to about 6 to 10-ft depths underlain by decomposed rocks and boulders to about 15 to 20 ft, the depths drilled. Borings along the east side of the site generally indicated decomposed rock at about 15-ft depths.

The proposed light residential houses may be supported either directly on stiff existing ground or on compacted fills constructed from on-site soils.

Some grading of the site involving low cuts and fills is contemplated. The earthwork should be done in accordance with the requirements of Chapter 23, Revised Ordinances of Honolulu, 1961 As Amended and the recommendations contained herein.

The report includes a Boring Location Plan, boring logs, laboratory test results, recommendations and limitations.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

Ezra Koike

Ezra Koike
Professional Engineer
Hawaii No. 1450

EK:rmf

C O N T E N T S

WAIPAHU ESTATES UNIT 3-1 - PRELIMINARY SOIL REPORT

WAIPIO, EWA, OAHU, HAWAII
TAX MAP KEY: 9-4-07: 11 & 24

SCOPE OF EXPLORATION

The purpose of this exploration was to determine general soil conditions for residential development for the proposed Waipahu Estates Unit 3-1.

This report includes field explorations, laboratory tests and general recommendations for site grading and residential foundation design.

FIELD EXPLORATION

Thirteen exploratory borings were made at the site. The approximate locations of these borings are shown on the Boring Location Plan. Descriptions of the underlying soils encountered are shown on Boring Logs Nos. 1 thru 13.

Borings were made with 4-in. diameter augers using a carbide drag bit. Soil samples were recovered with 2-in. thin-wall tube samplers and a standard split spoon sampler driven with a 140-lb hammer falling 30 inches.

LABORATORY TESTS

Laboratory tests included: natural water content and density, unconfined compression, Atterberg limit, sieve analysis, AASHO T-180-57 density, expansion and CBR.

A list of the standard field and laboratory test methods used for this project is given in the Appendix.

A summary of the laboratory test results is given in Tables IA and IB.

SOIL CLASSIFICATION SYSTEM

Soil samples were visually observed and subjected to appropriate tests in the laboratory. Based on visual observations and laboratory tests, the soil descriptions given on the boring logs are generally made in accordance with the "Unified Soil Classification System."

GENERAL SITE CONDITIONS

The proposed site is located along the south edge of the H-1 freeway and 3/4 mile north of the Oahu Sugar Mill at Waipahu, Oahu, Hawaii.

The site is a sugar cane field crossed with haul roads. A lined irrigation ditch cuts across the northern 1/3 of the site and an existing pump house is located near Boring No. 8. There were several plantation homes on the southwest section of the site at the time of the explorations.

The existing ground is relatively flat with gentle slopes at about a 5% grade sloping downward to the south with localized variations.

INTERPRETATION OF SOIL CONDITIONS

From the field exploration and laboratory test results, the soils may be generally described as follows:

Stiff reddish-brown clayey silts and silty clays to about 6 to 10-ft depths underlain by decomposed rocks and boulders to about 15 to 20 ft, the depths drilled.

Borings along the east side of the site generally indicated decomposed rock at about 15-ft depths.

Water was not noted in the borings during the field explorations.

For more detailed descriptions of soils encountered in the borings, refer to the boring logs.

DISCUSSION AND RECOMMENDATIONS

In general, the present plan is to clear and grade the site for residential development. The proposed grading is to use cut and fill slopes of generally less than 10 to 15 ft in height.

In the opinion of the Soil Engineer, the on-site soils, in general, have sufficient strength to support the fills and proposed light residential structures, provided the site is cleared and grubbed, drained and localized soft spots are removed.

Cesspools may be encountered near the existing plantation homes. They should be located on the Grading Plan prior to grading operations, if practicable. Sludge should be removed and the cesspool backfilled with granular material.

Decomposed rocks were encountered at about 6 to 10-ft depths in some borings. Because of the shallow depths to decomposed rocks, boulders will probably be found interspersed over the site. The closer an excavation approaches decomposed rocks, the greater will be the quantity of boulders. Boulders may be used to construct fill slopes outside of house lots. See Figure 1.

Site Grading

Surface vegetation, ditch linings and miscellaneous debris should be cleared and removed prior to site filling. Localized soft pockets encountered during the site preparations should be excavated and backfilled with compacted select material. Provisions to drain the site should be included during and after the completion of filling operations.

In general, the on-site soils may be used for the construction of the proposed fills. Grading work should be done as required by the F.H.A. Data Sheet 79-G; Revised Ordinances of Honolulu, 1961 As Amended; and as recommended below:

1. The area should be cleared and grubbed.

2. Topsoil and stockpiled soils should be either (a) stripped to stiff natural ground or (b) scarified and recompacted before the placement of fills.

3. The bottom and sides of irrigation ditches should be stripped down to stiff natural ground or scarified and recompacted before the placement of fills.

4. Hard surfaces along existing haul roads should be scarified down to stiff soils and

recompacted to match the density of the surrounding soil.

4. Fills should be constructed in approximately level layers starting at the lower end and working upward. Where fills are made on sloping areas steeper than about 5 horizontal to 1 vertical, the ground at the toe of the fill should be benched to a generally level condition. As the fill is brought up, it should be keyed continually into the stiff natural ground by cutting steps into the slopes and compacting the fill into these steps.

5. Fills should be laid in 6-in. compacted layers to 90% of the maximum density determined by the AASHO T-180-57 test method.

Existing Cesspools

Cesspools possibly may be encountered during the site preparation work where the plantation homes are located. When encountered, they should be flagged and located on the plans. Sludge should be removed from the bottom and the cesspool backfilled with fairly well-graded granular

materials. The materials should be placed in thin layers and rammed into place or compacted with vibratory equipment. The top 5 ft of fill should be compacted in 6-in. compacted layers.

Building foundations should be designed to bridge over the cesspool.

Slopes

In general, cut and fill slopes of 2 horizontal to 1 vertical or flatter should be used.

If slope heights (top to toe) of greater than 15 ft are considered, 8-ft-wide benches should be placed at about 15 to 20-ft height intervals.

To minimize erosion, the runoff from rainstorms should be diverted by berms or ditches away from slopes whenever practicable.

The surface of fill slopes should be compacted by cat-tracking or with a sheepsfoot roller.

Slope planting is recommended on cut and fill slopes to minimize erosion.

Slope adjustments or other precautions may be necessary if seepage zones or soft spots are encountered in localized areas.

Foundations

If earthwork is carried out as specified, the stiff natural ground and compacted fills should develop adequate bearing values to support the proposed light residential structures.

For light one and 2-story houses, differential settlements will probably be negligible and within the settlement tolerances of residential structures.

General recommendations for foundation construction are as follows:

1. For the proposed light one-story residential structures, conventional house foundations such as slab-on-ground construction or post-and-beam construction may be used.

2. Bearing values for a given soil usually vary with the size and depth of footings. For light, one and 2-story structures, bearing values of about 2000 p.s.f. may be used.

3. Soft spots or pockets of loose material encountered in footing excavations or below the building area should be excavated and backfilled with well-graded granular material such as S4C or other approved material.

4. Concrete slabs on ground should be placed over a base course of 4 in. of well-graded gravel less than 3/4-in. and greater than 1/4-in. in size. The subgrade should be compacted and shaped to a level surface or to drain, if practicable, and generally should be kept slightly higher than the finish grade outside the building.

5. Because of the downhill creep effect of soils on a slope, some settlements may occur near the tops of slopes. Buildings should generally be placed about 15 ft from the tops of slopes. This distance may be reduced for lower slope heights, e.g., 10 ft for 10-ft-high slopes, but generally not closer than 5 ft from the top of any slope.

6. Construction of retaining walls on slopes should generally be avoided.

7. Good surface drainage away from the foundation of structures should be maintained and the site should be graded at all times to prevent the ponding of water.

Roadway

In general, a rough estimate of the roadway pavement thickness for the light residential traffic anticipated is as follows:

1. Wearing course - 2-in. asphaltic concrete.
2. Base course - 6-in. base course over a prepared subgrade.

Provisions should be made in the contract documents to allow for local adjustments regarding subbase requirements in the field in accordance with the design standards of the City and County of Honolulu. In fill areas, the use of select soils within the top 2 to 3 ft of the subgrade may reduce the thickness or eliminate the need for the subbase course.

The subgrade should be compacted and shaped to drain. To avoid the ponding of water and softening of the subgrade at low points, weep holes should be placed at subgrade levels thru the walls of the catch basins which are placed in these low areas.

Utilities

Utilities should be placed after the fills are constructed. Utility lines should be designed with flexible joints, particularly where lines are connected to structures.

Unforeseen Conditions

Unforeseen or undetected conditions such as soft spots and abandoned utilities may occur in localized areas and will have to be adjusted and corrected in the field as they are detected.

PROPOSED SPECIFICATION FOR EARTHWORK

WAIPAHU ESTATES - UNIT 3-1

General Description

This item shall consist of clearing and grubbing, preparing of land to be filled, excavating and filling of the land, spreading, compacting and testing of the fill, and subsidiary work necessary for grading the site.

Clearing, Grubbing and Preparing Areas to be Filled

Vegetation and rubbish shall be removed and disposed of, leaving the disturbed area with a neat, debris-free appearance.

Vegetable matter shall be removed from the surface upon which fill is to be placed. Topsoil and stockpiled soils shall be (1) stripped to stiff natural ground or (2) scarified and recompacted before the placement of fills. Loose surface soils encountered at finish grade shall be scarified and recompacted.

The bottom and sides of irrigation ditches shall be stripped down to stiff natural ground or scarified and recompacted before the placement of fills.

Cane haul roads shall be scarified and recompacted to match the density of the surrounding soil.

Materials

Fill material shall consist of selected on-site soils or approved borrow soils. The soils shall contain no more than a trace of organic and deleterious matter.

Borrow soils shall be select soils generally less than 3-in. maximum size, with more than 30% fines and a plasticity index generally less than 20.

Fill material placed in the top 2 ft of fills shall contain less than 30% gravel.

Placing, Spreading and Compacting Fill Material

The selected fill material shall be placed in level layers which, when compacted, shall not exceed 6 inches. Each layer shall be spread evenly and thoroughly blade-mixed during the spreading to insure uniformity of material and water content within each layer.

Rocks or cobbles shall not be allowed to nest and voids between rocks shall be carefully filled and compacted with small stones or earth.

When the water content of the fill material is well below the optimum for compacting purposes, water shall be added until the water content assures a thorough bonding during the compacting process.

When the water content of the material is well above the optimum for compacting purposes, the fill material shall be aerated by blading or by other satisfactory methods until the water content is near the optimum.

After each layer has been placed, mixed and spread evenly, it shall be compacted to 90% of maximum density in accordance with AASHO Test No. T-180-57 or other comparable density tests. Compaction shall be with sheepsfoot rollers, multiple-wheel pneumatic-tired rollers or other acceptable rollers which shall be able to compact the fill to the specified density. Rolling shall be accomplished while the fill material is at the specified water content. The rolling of each layer shall be continuous over its entire area and the roller shall make sufficient passes to obtain the desired density.

Field density tests shall be made to get an indication of the compaction of the fill. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density readings shall be taken as often as necessary in the compacted material below the disturbed surface. When these readings indicate that the density of any layer of fill or portion thereof is below the required 90% density, that layer or portion shall be reworked until the required density has been obtained.

The fill operation shall be continued in 6-in. compacted layers, as specified above, until the fill has been brought to the finished slopes and grades as shown on the accepted plans.

Backfilling of Old Cesspools

The following procedures shall be followed for backfilling:

(1) Sludge Removal

Remove the sludge from the bottom of the old cesspool by (a) pumping or (b) by clamshell or any other suitable way. The material shall be disposed of away from the site. The completeness of removal shall be verified by probing and the sludge shall be less than 12 in. at the bottom.

(2) Granular Fill (below 3 ft from finish grade)

Use granular material, graded from 6 to 0 inches. The fines passing the No. 200 sieve shall be less than 10%.

The materials shall be placed in thin layers (12 in. maximum) and compacted with vibratory equipment to 90% of AASHO T-180-57 density. Ramming each layer into place with a clamshell bucket will be allowed. The granular fill shall be wetted before placement into the cesspools. Sufficient compaction tests shall be conducted to verify that 90% compaction is obtained by the construction method selected.

(3) Top 3 Ft of Fill

Linings encountered in the cesspools within the top 3 ft from finish grade shall be removed. The fill within the top 3 ft from finish grade shall be constructed from on-site soil in thin layers (6-in. compacted thickness) to 90% of AASHO T-180-57 density. The material at finish grade shall blend with the surrounding soil.

Excavation

Suitable material from excavation shall be used in the fill and unsuitable material from excavation shall be disposed of.

Unforeseen Conditions

If unforeseen or undetected critical soil conditions such as soft spots or seepage water are encountered during the field operations, corrective measures shall be made in the field as they are detected.

Rainy Weather

Fill material shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests indicate that the water content and density are as previously specified.

BORING LOGS

The stratification lines shown on each of the boring logs represent the approximate boundary between soil types and the transition may be gradual.

Symbols

Symbols used generally are in accordance with the Unified Soil Classification System.

Where a parenthesis "(MH)" is used, the soil sample was classified by visual observation of the sample recovered.

Where no parenthesis "MH" is used, the soil sample was classified from either the Atterberg limit or sieve analysis test results.

WAIPAHU ESTATES UNIT 3-1

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT WAIPAHU ESTATES UNIT 3-1

LOCATION Waipio, Ewa, Oahu, Hawaii

Tax Map Key: 9-4-07: 11 & 24

HAMMER:

Weight 140 #

Drop 30"

SAMPLER: 2"S.S - 2" STANDARD SPLIT SPOON
2"S - 2" O.D. THIN WALL TUBE

BORING NO. 1 Sheet No. ____ of ____

Driller W. LUM ASSOC., INC. Date 8-18-71

Field Party KAKU & GLORY

Type of Boring AUGER (B-30) Diam. 4"

Elev. 155' ± * Datum —

Drill Bit J.C. DRAG

Water Level	NOT NOTICED			
Time	—			
Date	8-18-71			

Unified Soil Classification	DESCRIPTION ELEV. = 155' ± *	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
(ML-CL)	STIFF REDDISH BROWN SILTY-CLAY		2"S.S.	1-A	—	21	—	—	—		
	NOTE: USED WATER TO AID DRILLING	5	2"S	1-B	122	31	93	7700	—		13/.5'
	BROWN & REDDISH BROWN SILTY-CLAY (CUTTINGS)										
(ML)	STIFF REDDISH BROWN CLAYEY SILT W/ BLACK MATTER	10	2"S.S.	1-C	—	27 28	—	—	—		
(ML)	STIFF BROWN CLAYEY SILT W/ TRACES OF DECOMPOSED ROCK										
(MH)	STIFF MOTTLED BROWN & GRAY CLAYEY SILT W/TRACES OF DEC. ROCK	15	2"S	1-D	104	41	74	5100	—		3/.5', 4/.5'
	END OF BORING @ 16.0'										

*ELEVATION ESTIMATED FROM CONTOUR PLAN

WAIPAHU ESTATES UNIT 3-1

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT WAIPAHU ESTATES UNIT 3-1
LOCATION Waipio, Ewa, Oahu, Hawaii
Tax Map Key: 9-4-07: 11 & 24

HAMMER:
Weight 140#
Drop 30"
SAMPLER: 2" SS : 2" STANDARD SPLIT SPOON
2" S : 2" O.D. THIN WALL TUBE

BORING NO. 2 Sheet No. ____ of ____
Driller W. LUM ASSOC, INC. Date AUG. 17, 1971
Field Party KAKU, GLORY
Type of Boring AUGER (B-30) Diam. 4"
Elev. 156'± * Datum —
Drill Bit T.C. DRAG

Water Level	NOT NOTICED				
Time	—				
Date	8-17-71				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2"O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV. = 156'± *	0									
(ML)	MEDIUM REDDISH BROWN CLAYEY-SILT W/ ROOTS		2"SS	2-A	-	15	-	-	-		25/.5' HAMMER BOUNCES
	NOTE: DRILL TIME = 15 MIN. DEPTH = 1'-1.5'				NOTE: HIT ROCK AT 1.0' MOVED HOLE 5' AWAY.						
(ML)	STIFF REDDISH BROWN CLAYEY SILT	5	2"S	2-B	128	27	100	7590	-		12/.5' HAMMER BOUNCES
(MH)	STIFF DARK BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCKS	10	2"SS	2-C	-	31	-	-	-		
	REDDISH BROWN SILTY CLAY (CUTTINGS)										
	ROCK OR BOULDER	15	2"SS	2-D		NO	RECOVERY				20/.0' HAMMER BOUNCES
	END OF BORING @ 15.0'										
	NOTE: DRILL TIME = 30 MIN. DEPTH = 14.5'-15'										

* ELEVATION ESTIMATED FROM CONTOUR PLAN

WAIPAHU ESTATES UNIT 3-1

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT WAIPAHU ESTATES UNIT 3-1
LOCATION Waipio, Ewa, Oahu, Hawaii
Tax Map Key: 9-4-07: 11 & 24

HAMMER:
Weight 140#
Drop 30"
SAMPLER: 2" SS: 2" STANDARD SPLIT SPOON
2" S: 2" O.D. THIN WALL TUBE

BORING NO. 3 Sheet No. ____ of ____
Driller W. LUM & ASSOC., INC. Date AUG. 17, 1971
Field Party KAKU, GLORY
Type of Boring AUGER (B-30) Diam. 4"
Elev. 157'± * Datum —
Drill Bit T.C. DRAG

Water Level	NOT NOTICED				
Time	—				
Date	8-17-71				

Unified Soil Classification	DESCRIPTION ELEV.= 157'±? *	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA Standard Penetration Test N (Blows per foot) 0 10 20 30 40	2" O.D. THIN WALL TUBE SAMPLER BLOWS /0.5'
(ML)	MEDIUM, REDDISH BROWN, CLAYEY SILT W/ ROOTS	0	2"SS	3-A	-	10	-	-	-		
(ML)	MEDIUM, REDDISH BROWN CLAYEY SILT NOTE: DRILL TIME - 10 MIN. DEPTH - 6.5'-10'	5	2"S	3-B	116	26	91	11960	-		8/.5, 6/.5
	DECOMPOSED ROCK (PUKA PUKA) NOTE: DRILL TIME - 10 MIN. DEPTH - 10'-15'	10	2"SS	3-C	-	20	-	-	-	13/.5' 20/0'	HAMMER BOUNCES
	MOTTLED GRAY & BROWN DECOMPOSED ROCK END OF BORING @ 15.5'	15	2"SS	3-D	-	31	-	-	-	30/.5	HAMMER BOUNCES

EASY DRILLING

ROUGH & EASY DRILLING

* ELEVATION ESTIMATED FROM CONTOUR PLAN

WAIPAHU ESTATES UNIT 3-1

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT WAIPAHU ESTATES UNIT 3-1
LOCATION Waipio, Ewa, Oahu, Hawaii
Tax Map Key: 9-4-07: 11 & 24

HAMMER:
Weight 140 #
Drop 30"
SAMPLER: 2" SS. 2" STANDARD SPLIT SPOON
2" S. 2" O.D. THIN WALL TUBE

BORING NO. 4 Sheet No. ____ of ____
Driller W. LUM & ASSOC., INC. Date AUG. 18, 1971
Field Party KAKU, GLORY
Type of Boring AUGER (B-30) Diam. 4"
Elev. 153'± * Datum —
Drill Bit T.C. DRAG
Water Level NOT NOTICED
Time —
Date 8-18-71

Unified Soil Classification	DESCRIPTION ELEV. = 153'± *	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
(ML)	STIFF REDDISH BROWN CLAYEY SILT		2" S.S.	4-A	-	23	-	-	-		
MH	STIFF BROWN CLAYEY SILT	5	2" S	4-B	115	30 LL-51 PL-38	88	5960	-		10/.5'
(MH)	STIFF MOTTLED REDDISH BROWN CLAYEY SILT W/ DEC. ROCK	10	2" S.S.	4-C	-	33 33	-	-	-		
(MH)	STIFF BROWN CLAYEY SILT										
	MOTTLED BROWN & GRAY DECOMPOSED ROCK	15	2" S	4-D	97	36	72	-	-		5/.5', 10/.5'
	ROCK & DECOMPOSED ROCK										
	ROCK OR BOULDER										
	MOTTLED GRAY & BROWN DECOMPOSED ROCK	20	2" S.S.	4-E	-	22	-	-	-		20/.5' 30/.4 HAMMER BOUNCES
	END OF BORING @ 20.5'										

NOTE: DRILL TIME - 10 MIN.
DEPTH - 16.5'-17'
DRILL TIME - 15 MIN.
DEPTH - 18'-19.5

ROUGH DRILLING

ROUGH DRILLING

*ELEVATION ESTIMATED FROM CONTOUR PLAN

KAIPAHU ESTATES UNIT 3-1

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: WAIPAHU ESTATES UNIT 3-1
LOCATION: Waipio, Ewa, Oahu, Hawaii
Tax Map Key: 9-4-07: 11 & 24

HAMMER:
Weight: 140 #
Drop: 30"
SAMPLER: 2" SS. 2" STANDARD SPLIT SPOON
2" S. 2" O.D. THIN WALL TUBE

BORING NO. 5 Sheet No. ____ of ____
Driller: W. LUM & ASSOC., INC. Date: AUG. 18 & 19, 1971
Field Party: KAKU, GLORY
Type of Boring: AUGER (B-30) Diam.: 4"
Elev.: 120'± * Datum: —
Drill Bit: T.C. DRAG

Water Level					
Time	—				
Date	8-18-71				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
(ML)	STIFF, REDDISH BROWN CLAYEY SILT		2"SS	S-A	-	23	-	-	-		
	NOTE: USED WATER TO AID DRILLING	5									
	STIFF, REDDISH BROWN & TAN		2"S	S-B	119	20	93	8290	-		7/.5 12/.5
(ML)	CLAYEY SILT										
	STIFF, MOTTLED REDDISH	10									
(ML)	BROWN, CLAYEY SILT W/ DECOMPOSED ROCK		2"SS	S-C	-	33	-	-	-		
	MOTTLED BROWN DECOMPOSED ROCK W/ SILTY CLAY POCKETS	15	2"S	S-D	94	42	66	-	-		10/.5
	END OF BORING @ 15.5'										

* ELEVATION ESTIMATED FROM CONTOUR PLAN

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: WAIPAHU ESTATES UNIT 3-1
LOCATION: Waipio, Ewa, Oahu, Hawaii
Tax Map Key: 9-4-07: 11 & 24

HAMMER:
Weight: 140 #
Drop: 30"
SAMPLER: 18" SS - 2" STANDARD SPLIT SPOON
18" S - 2" O.D. THIN WALL TUBE

BORING NO. G Sheet No. ____ of ____
Driller W. LUM & ASSOC., INC. Date AUG. 18 & 19, 1971
Field Party MAESHIRO, TSUKAZAKI
Type of Boring AUGER (ACKER ACE) Diam. 4"
Elev. 140'± * Datum —
Drill Bit T.C. DRAG
Water Level NOT NOTICED
Time —
Date 8-19-71

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV. = 140'±										
(ML-CL)	STIFF, REDDISH BROWN SILTY CLAY W/ ROOTS		2"SS	G-A	-	17	-	-	-		
ML	STIFF, BROWN CLAYEY SILT	5	2"S	G-B	114	20	88	-	-		8/.5 , 15/.5
						LL-47 PL-35					
	COBBLE		SOC								
ML	STIFF REDDISH BROWN SILTY CLAY W/ TRACES OF DECOMPOSED ROCK	10	2"SS	G-C	-	27	-	-	-		
						LL-49 PL-28					
	GRAY, LAVA (PUKA PUKA) ROCK CUTTINGS	15	2"SS	G-D	-	-	-	-	-		40/.5
	GRAY W/ RED DECOMPOSED ROCK	20	2"SS	G-E	-	42	-	-	-		
	END OF BOKING @ 21.5'										

ROUGH DRILLING

ROUGH DRILLING

* ELEVATION ESTIMATED FROM CONTOUR PLAN

WAIPAHU ESTATES UNIT 3-1

WALTER LUM ASSOCIATES, INC.

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: WAIPAHU ESTATES UNIT 3-1

LOCATION: Waipio, Ewa, Oahu, Hawaii

Tax Map Key: 9-4-07: 11 & 24

HAMMER:

Weight: 140 #

Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 7 Sheet No. _____ of _____

Driller: W. LUM & ASSOC., INC. Date: AUG. 18, 1971

Field Party: MAESHIRO, TSUKAZAKI

Type of Boring: AUGER (ACKER DCE) Diam.: 4"

Elev.: 138'± * Datum: -

Drill Bit: T.C. DRAG

Water Level	NOT NOTICED				
Time	-				
Date	8-18-71				

Unified Soil Classification	DESCRIPTION ELEV.: 138'± *	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA Standard Penetration Test N (Blows per foot) 0 10 20 30 40 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
(ML)	STIFF, REDDISH BROWN SILTY CLAY W/ COBBLES, ROOTS & TRACES OF CORAL (FILL?)			7-A	-	17	-	-	-	22/.5
	COBBLES OR BOULDER	5		7-B		NO RECOVERY				
(ML)	STIFF, REDDISH BROWN CLAYEY SILT	10								
(ML)	STIFF, BROWN CLAYEY SILT			7-C	-	31	-	-	-	7/.5 15/.5
(ML)	STIFF, DARK BROWN CLAYEY SILT W/ DECOMPOSED ROCK	15		7-D	-	34	-	-	-	
	END OF BORING @ 16.5'									

* ELEVATION ESTIMATED FROM CONTOUR PLAN

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT WAIPAHU ESTATES UNIT 3-1

LOCATION Waipio, Ewa, Oahu, Hawaii

Tax Map Key: 9-4-07: 11 & 24

HAMMER:
Weight 140#
Drop 30"

SAMPLER: 2" S.S. - 2" STANDARD SPLIT SPOON
2" S. - 2" O.D. THIN WALL TUBE

BORING NO. 8 Sheet No. ____ of ____

Driller W. LUM & ASSOC., INC. Date AUG. 17, 1971

Field Party KAKU, GLORY

Type of Boring AUGER (B-30) Diam. 4"

Elev. 136'± * Datum —

Drill Bit T.C. DRAG

Water Level	NOT NOTICED				
Time	—				
Date	8-17-71				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV. = 136'± *										
(ML)	MEDIUM REDDISH BROWN CLAYEY SILT W/ROOTS		2"SS	B-A	—	21	—	—	—		
(ML)	STIFF REDDISH BROWN CLAYEY SILT	5	2"S.	B-B	117	30	90	—	—		6/.5 12/.5
	BROWN CLAYEY SILT (CUTTINGS)										
	COBBLE OR BOULDER	10	2"S.S.	B-C		NO RECOVERY					30/.1 HAMMER BOUNCES
	NOTE: DRILL TIME - 30 MIN DEPTH - 10'-11'										
	GRAY & REDDISH BROWN DECOMPOSED ROCK	15	2"S.S.	B-D	—	98	—	—	—		
	END OF BORING @ 16.5'										

*ELEVATION ESTIMATED FROM CONTOUR PLAN

STIFF DRILLING

STIFF DRILLING

WAIPAHU ESTATES UNIT 3-1

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT WAIPAHU ESTATES UNIT 3-1
LOCATION Waipio, Ewa, Oahu, Hawaii
Tax Map Key: 9-4-07: 11 & 24

HAMMER:
Weight 140 #
Drop 30"
SAMPLER: 2" S.S. - 2" STANDARD SPLIT SPOON
2" S.T. - 2" O.D. THIN WALL TUBE

BORING NO. 9 Sheet No. ____ of ____
Driller W. LUM & ASSOC., INC. Date AUG. 19, 1971
Field Party KAKU, GLORY
Type of Boring AUGER (B-30) Diam. 4"
Elev. 120' ± * Datum —
Drill Bit T.C. DRAG
Water Level NOT NOTICED
Time —
Date 8-19-71

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV. = 120' ± *										
(ML)	STIFF REDDISH BROWN CLAYEY SILT		2" S.S.	D-A	-	24	-	-	-		
	BROWN CLAYEY SILT (CUTTINGS)	5									
			2" S.T.	D-B	110	25	88	-	-		10/.5
(MH)	STIFF, REDDISH BROWN W/ BROWN CLAYEY SILT										
		10									
	STIFF MOTTLED REDDISH BROWN CLAYEY SILT		2" S.S.	D-C	-	33	-	-	-		
	ROCK OR BOULDER	15									
	MOTTLED BROWN DECOMPOSED ROCK (SOME CRUSHES TO SILTY SAND)		2" S.S.	D-D	-	32	-	-	-		

*ELEVATION ESTIMATED FROM CONTOUR PLAN

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: WAIPAHU ESTATES UNIT 3-1
LOCATION: Waipio, Ewa, Oahu, Hawaii
Tax Map Key: 9-4-07: 11 & 24

HAMMER:
Weight 140 #
Drop 30"
SAMPLER: 2" S.S. - 2" STANDARD SPLIT SPOON
2" S. 2" O.D. THIN WALL TUBE

BORING NO. 10 Sheet No. ____ of ____
Driller W. LUM & ASSOC., INC. Date AUG. 10, 1971
Field Party MAESHIRO, TSUKAZAKI
Type of Boring AUGER (ACKER ACE) Diam. 4"
Elev. 122'± * Datum —
Drill Bit T.C. DRAG

Water Level					
Time	—				
Date	8-10-71				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV. = 122'± *										
(ML-CL)	STIFF REDDISH BROWN SILTY-CLAY W/ ROOTS		2"S.S.	10-A	-	20	-	-	-		
(MH)	STIFF, RED-BROWN SILTY CLAY	5									
	DECOMPOSED GRAY LAVA ROCK (PUKA-PUKA)		2"S.	10-B	110	26	87	4840	-		8/5, 13/5
	GRAY W/ RED DECOMPOSED ROCK (SOME CRUSHES TO SILTY SAND)	10	2"S.S.	10-C	-	37	-	-	-		
	GRAY W/ BROWN DECOMPOSED ROCK	15	2"S.	10-D	-	33	-	-	-		
	END OF BORING @ 16.5'										

*ELEVATION ESTIMATED FROM CONTOUR PLAN

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT WAIPAHU ESTATES UNIT 3-1

LOCATION Waipio, Ewa, Oahu, Hawaii

Tax Map Key: 9-4-07: 11 & 24

HAMMER:

Weight 140 #

Drop 30"

SAMPLER: 2" S.S. - 2" STANDARD SPLIT SPOON
2" S.S. - 2" O.D. THIN WALL TUBE

BORING NO. 11 Sheet No. ____ of ____

Driller W. LUM ASSOC, INC. Date AUG. 18, 1971

Field Party MAESHIRO, TSUKAZAKI

Type of Boring AUGER (ACKER ACE) Diam. 4"

Elev. 120'± * Datum —

Drill Bit T.C. DRAG

Water Level	NOT NOTICED				
Time	—				
Date	8-18-71				

Unified Soil Classification	DESCRIPTION ELEV. = 120'± *	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA Standard Penetration Test N (Blows per foot) 0 10 20 30 40 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
(ML)	STIFF, REDDISH BROWN CLAYEY SILT W/ ROOTS & TRACES OF CORAL (FILL?)	5	2"S.S.	11-A	—	17	—	—	—	
(ML)	STIFF, REDDISH BROWN CLAYEY SILT		2"S.	11-B	109	28	86	4840	—	5/.5, 5/.5
	MOTTLED BROWN & RED DECOMPOSED ROCK W/ CLAYEY SILT	10	2"S.S.	11-C	—	38	—	—	—	10/.5' 20/.1
	GREENISH GRAY LAVA (PUKA-PUKA) ROCK		2"S.S.	11-D	NO	RECOVERY				40/.1 HAMMER BOUNCES
	END OF BORING @ 19.1'									
	NOTE: DRILL TIME - 30 MIN DEPTH - 10.6'-13'									
	*ELEVATION ESTIMATED FROM CONTOUR PLAN									

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT WAIPAHU ESTATES UNIT 3-1

LOCATION Waipio, Ewa, Oahu, Hawaii

Tax Map Key: 9-4-07: 11 & 24

HAMMER:
Weight 140 #
Drop 30"

SAMPLER: 2"S.S. - 2" STANDARD SPLIT SPOON
2"S - 2" O.D. THIN WALL TUBE

BORING NO. 12 Sheet No. ____ of ____

Driller W. LUM ASSOC., INC. Date AUG. 16, 1971

Field Party KAKU, GLORY

Type of Boring AUGER (B-30) Diam. 4"

Elev. 113'± * Datum —

Drill Bit T.C. DRAG

Water Level	NOT NOTICED				
Time	—				
Date	8-16-71				

Unified Soil Classification	DESCRIPTION ELEV.= 113'± *	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
(ML)	STIFF, REDDISH BROWN CLAYEY SILT		2"SS	12-A	-	22	-	-	-		
(MH)	STIFF, REDDISH BROWN SILTY CLAY	5	2"S	12-B	111	30	85	-	-		5/.5 8/.5
	STIFF MOTTLED REDDISH BROWN	10									
(MH)	CLAYEY SILT		2"S.S.	12-C	-	34	-	-	-	10/.5	
(MH)	STIFF BROWN SILTY CLAY					34				16/.5	
	STIFF REDDISH BROWN	15									
(MH)	SILTY CLAY		2"S	12-D	111	30	85	4630	-		4/.5 5/.5
	END OF BORING @ 16.0'										

*ELEVATION ESTIMATED FROM CONTOUR PLAN

WAIPAHU ESTATES UNIT 3-1

STIFF DRILLING

WAIPAHU ESTATES UNIT 3-1

WALTER LUM ASSOCIATES, INC.

3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT WAIPAHU ESTATES UNIT 3-1

LOCATION Waipio, Ewa, Oahu, Hawaii

Tax Map Key: 9-4-07: 11 & 24

HAMMER:

Weight 40#

Drop 30"

SAMPLER: 2"S.S. : 2" STANDARD SPLIT SPOON
2" S - 2" O.D. THIN WALL TUBE

BORING NO. 13 Sheet No. ____ of ____

Driller N. LUM ASSOC., INC. Date AUG. 10, 1971

Field Party KAKU, GLORY

Type of Boring AUGER (B-30) Diam. 4"

Elev. 118'± * Datum —

Drill Bit T.C. DRAG

Water Level	NOT NOTICED				
Time	—				
Date	8-17-71				

Unified Soil Classification	DESCRIPTION ELEV. = 118'± *	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
(ML)	STIFF REDDISH BROWN CLAYEY SILT W/ROOTS.	0	2"SS	13-A	-	25	-	-	-		
	NOTE: USED WATER TO AID DRILLING	5									
(MH)	STIFF REDDISH BROWN SILTY CLAY		2"S	13-B	112	30	87	7280	-		8/.5
(MH)	STIFF REDDISH BROWN CLAYEY SILT W/ROOTS & TAN CLAYEY SILT	10	2"SS	13-C	-	29	-	-	-		
	BLUE-GRAY & REDDISH BROWN, DECOMPOSED ROCK (SOME CRUSHES TO CLAYEY SILT)	15	2"S	13-D	111	33	83	9360	-		4/.5, 7/.5
	END OF BORING @ 16.0'										

* ELEVATION ESTIMATED FROM CONTOUR PLAN

WAIPAHU ESTATES · UNIT 3-1

TABLE I A - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	4	4		6
SAMPLE NO.		B		
DEPTH BELOW SURFACE	SURFACE	5'-5.5'		SURFACE
DESCRIPTION	REDDISH-BROWN CLAYEY SILT	BROWN CLAYEY SILT		REDDISH-BROWN SILTY CLAY
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1"				100
1/2"				100
#4				99.9
#10				99.5
#20				98.8
#40				97.2
#100				94.6
#200				93.0
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL		NATURAL
Liquid Limit	32	51		42
Plastic Limit	27	38		25
Plasticity Index	5	13		17
Dilatancy	QUICK	QUICK		MEDIUM
Toughness	MEDIUM	SLIGHT		MEDIUM
Dry Strength	SLIGHT-MED	SLIGHT-MED.		MEDIUM
UNIFIED SOIL CLASSIFICATION	ML	MH		ML-CL
APPARENT SPECIFIC GRAVITY	2.91			2.92
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %	22.5			23.3
Molding Dry Density, P.C.F.	100.5			103.8
Swell upon saturation, %	1.0			0.3
CBR at 0.1" Penetration	25.0			13.3
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-57 Method ___)	A			A
Dry to Wet or Wet to Dry	DRY TO WET			DRY TO WET
Max. Dry Density (P.C.F.)	101.5			103.2
Optimum Moisture (%)	23.8			23.9

REMARKS:

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date _____ By _____

WAIPAHU ESTATES - UNIT 3-1

TABLE I B - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	6	6		
SAMPLE NO.	B	C		
DEPTH BELOW SURFACE	5'-6'	10'-11.5'		
DESCRIPTION	BROWN CLAYEY SILT	REDDISH-BROWN SILTY CLAY W/TRACES OF DECOMP. ROCK		
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve 1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL		
Liquid Limit	47	49		
Plastic Limit	35	28		
Plasticity Index	12	21		
Dilatancy	SLOW-MED.	MEDIUM		
Toughness	SLIGHT	MEDIUM		
Dry Strength	SLIGHT-MED.	MEDIUM		
UNIFIED SOIL CLASSIFICATION	ML	ML		
APPARENT SPECIFIC GRAVITY				
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %				
Molding Dry Density, P.C.F.				
Swell upon saturation, %				
CBR at 0.1" Penetration				
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-57 Method ___)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

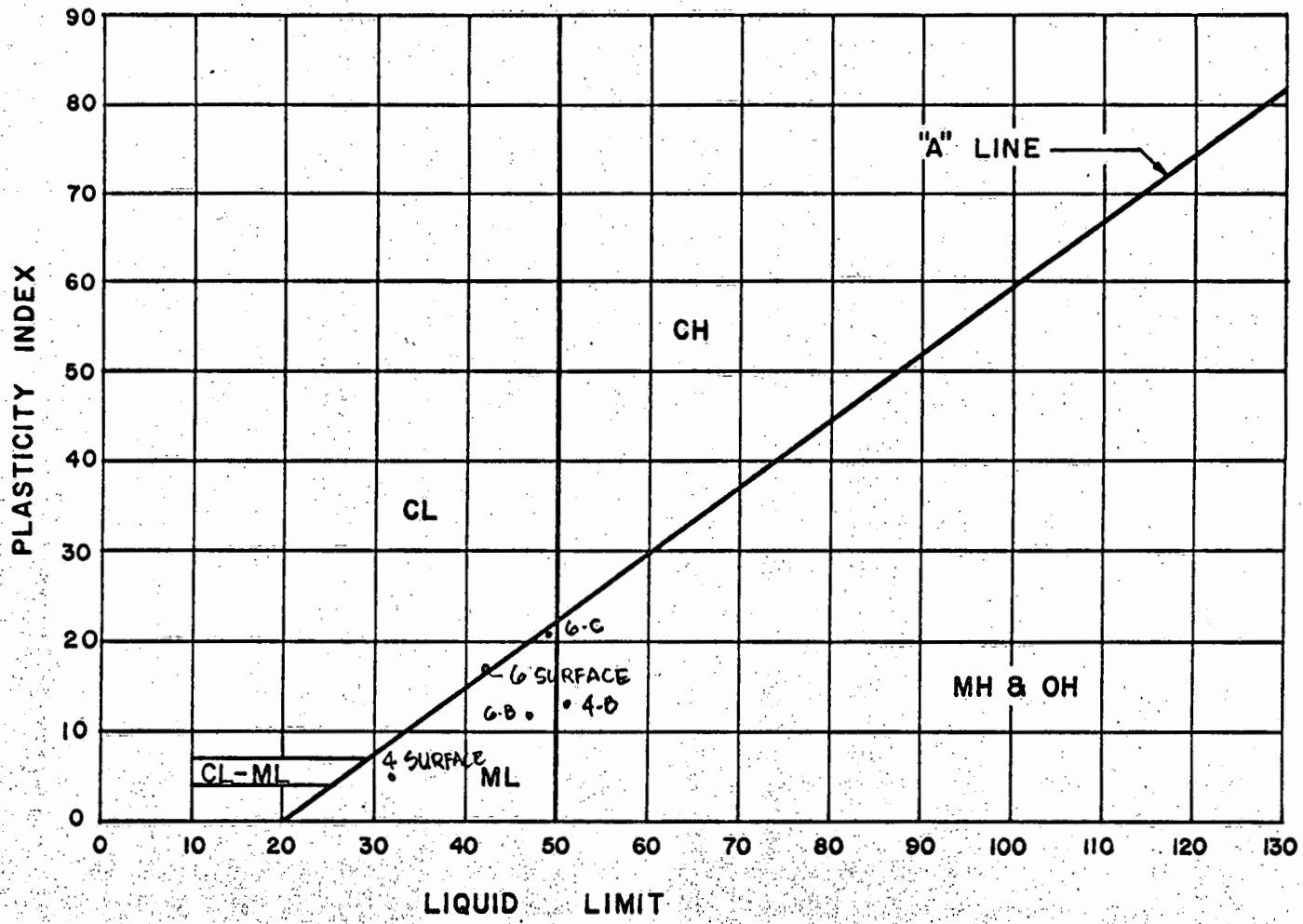
WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date _____ By _____

PLASTICITY CHART

PROJECT: WAIPAHU ESTATES - UNIT 3-1

LOCATION: WAIPIO, EWA, OAHU, HAWAII



WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DATE _____ BY _____

MOISTURE-DENSITY CURVE (AASHO T-180-57, METHOD A)

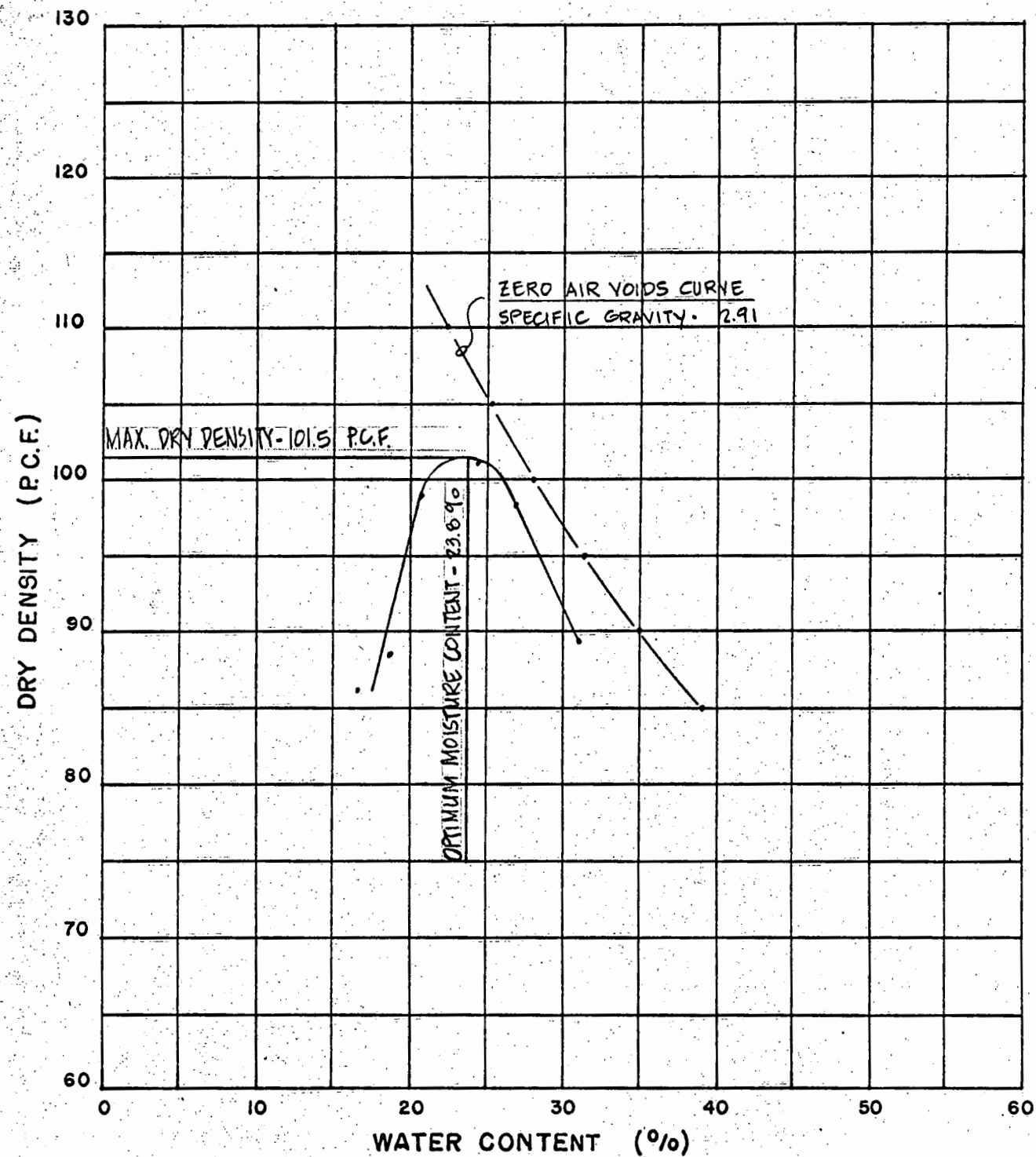
PROJECT: WAIPAHU ESTATES - UNIT 3-1

LOCATION: WAIPIO, EWA, OAHU, HAWAII

SAMPLE NO.: 4 SURFACE

SAMPLE DESCRIPTION: REDDISH-BROWN CLAYEY SILT

AGGREGATE: ¼" MINUS
MOLD SIZE: 4" & 4.59"
HAMMER: 10LBS, 18" DROP
LAYERS: 5
BLOWS: 25/LAYER



WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DATE 9-14-71 BY SK

MOISTURE-DENSITY CURVE (AASHO T-180-57, METHOD A)

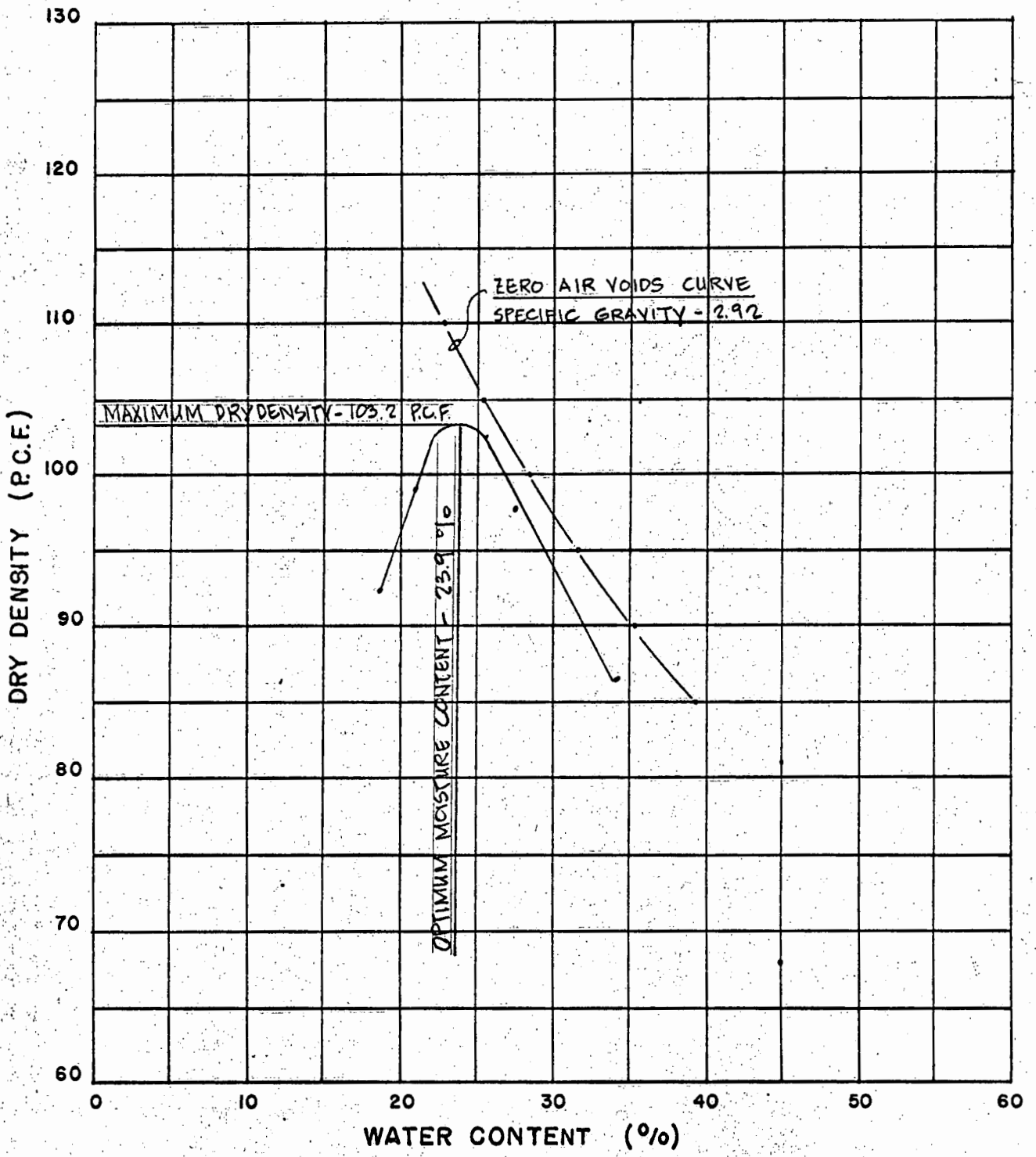
PROJECT: WAIPAHU ESTATES - UNIT 3-1

LOCATION: WAIPIO, EWA, OAHU, HAWAII

SAMPLE NO.: 6 SURFACE

SAMPLE DESCRIPTION: REDDISH-BROWN SILTY CLAY

AGGREGATE: ¼" MINUS
MOLD SIZE: 4" ϕ 4.59 HIGH
HAMMER: 10 LBS., 18" DROP
LAYERS: 5
BLOWS: 25/LAYER



WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DATE 9-27-71 BY SK

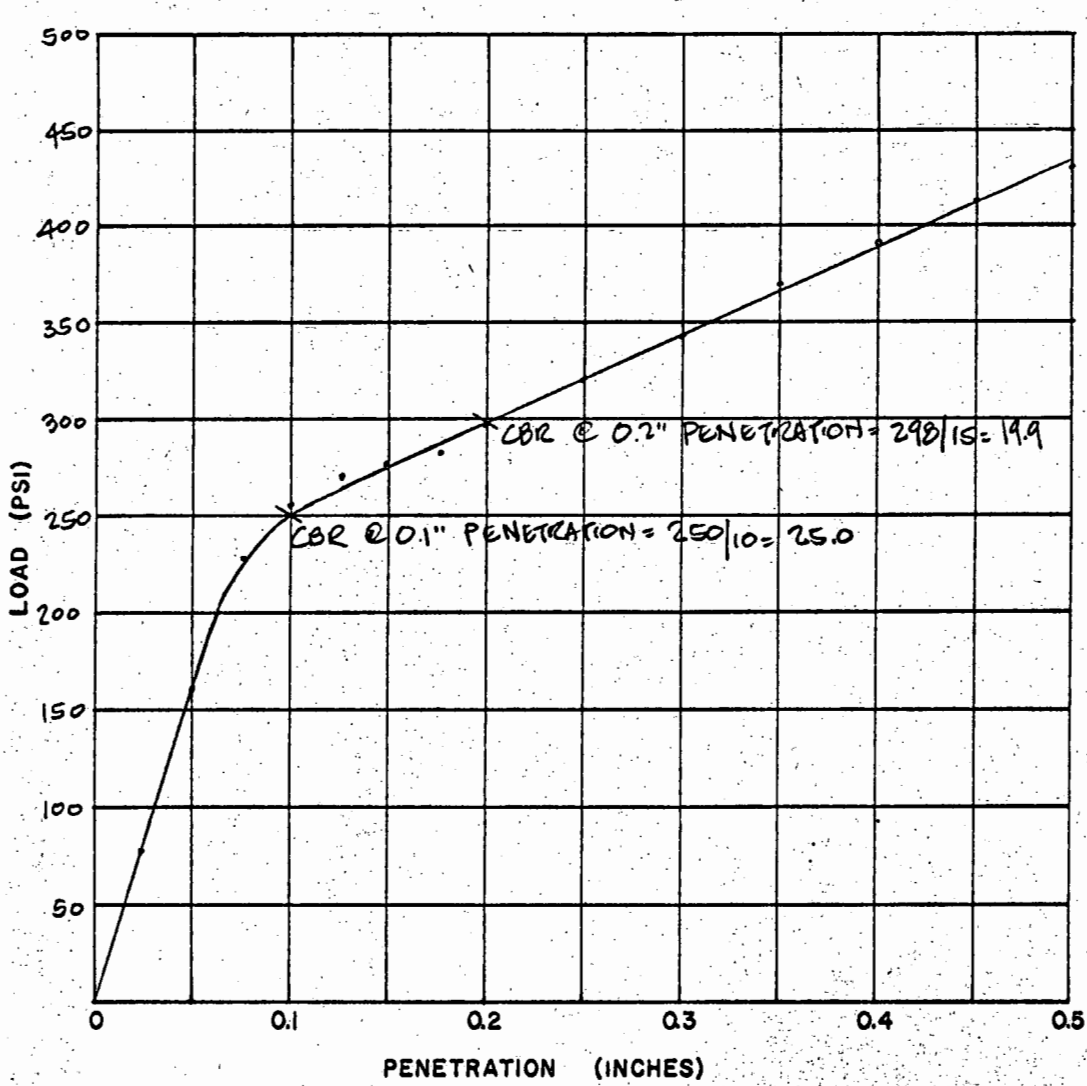
CBR TEST

PROJECT: WAIPAHU ESTATES - UNIT 3-1

LOCATION: WAIPIO, EWA, OAHU, HAWAII

SAMPLE NO: 4 SURFACE

SAMPLE DESCRIPTION: REDDISH-BROWN CLAYEY SILT



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	230	77
0.050	480	160
0.075	680	227
0.100	760	253
0.125	810	270
0.150	830	277
0.175	850	283
0.200	890	297
0.250	960	320
0.300	1030	343
0.350	1110	370
0.400	1170	390
0.450	1240	413
0.500	1290	430

AGGREGATE 1/4" MINUS

HAMMER WEIGHT 10 LBS.

HAMMER DROP 18"

No. OF BLOWS 56/LAYER

No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 22.5

MOLDING DRY DENSITY, P.C.F. 100.5

CBR @ 0.1" PENETRATION 25.0

DAYS SOAKED 4

DATE 9-11-71 BY FM

DATE 9-16-71 BY SK

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

10-470

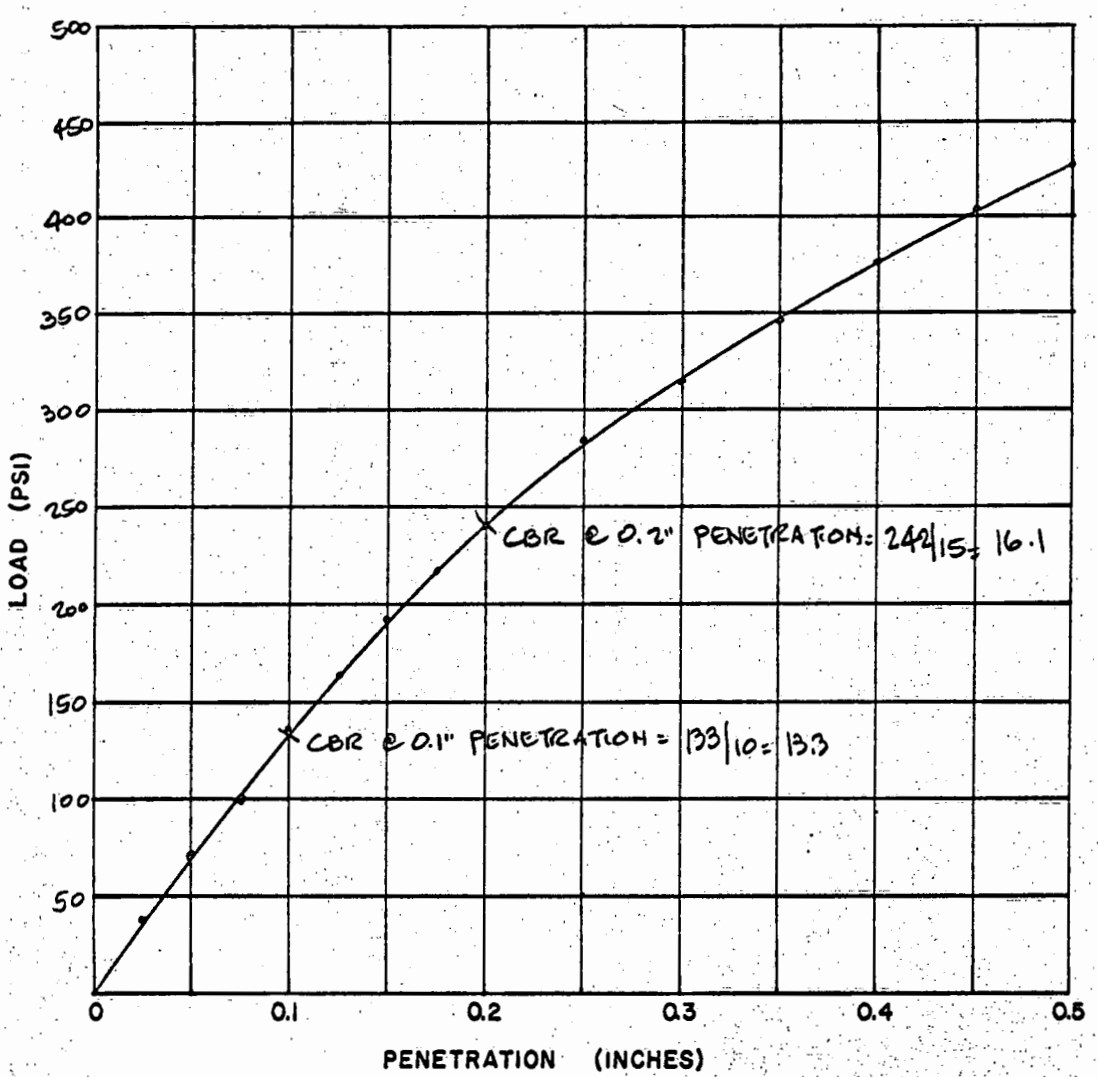
CBR TEST

PROJECT: WAIPAHU ESTATES - UNIT 3-1

LOCATION: WAIPIO, EWA, OAHU, HAWAII

SAMPLE NO: 6 SURFACE

SAMPLE DESCRIPTION: REDDISH-BROWN SILTY CLAY



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS)	LOAD (PSI)
0.025	110	37
0.050	210	70
0.075	300	100
0.100	410	137
0.125	490	163
0.150	580	193
0.175	650	217
0.200	720	240
0.250	850	283
0.300	945	315
0.350	1040	347
0.400	1130	377
0.450	1210	403
0.500	1280	427

AGGREGATE ¼" MINUS

HAMMER WEIGHT 10LBS.

HAMMER DROP 18"

No. OF BLOWS 56/LAYER

No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 23.3

MOLDING DRY DENSITY, P.C.F. 103.8

CBR @ 0.1" PENETRATION 13.3

DAYS SOAKED 4

DATE 9-14-71 BY AF

DATE 9-20-71 BY SK

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

GENERAL TESTING METHODS

EXPLORATORY BORINGS AND SAMPLING

Method for soil investigation and sampling by auger borings (Tentative)	ASTM Designation: D 1452-63T
Method for thin wall tube sampling of soils (Tentative)	ASTM Designation: D 1587-63T
Method for penetration test and split barrel sampling of soils (Tentative)	ASTM Designation: D 1586-64T

LABORATORY TESTING

Grading Analysis

Sieve analysis of fine and coarse aggregates	AASHO Designation: T 27-60
Amount of material finer than No. 200 sieve in aggregate	AASHO Designation: T 11-60

Atterberg Limits

Determining the liquid limit of soils Modified as follows: Substitute Casagrande grooving tool. Tests conducted from natural moisture content unless noted otherwise.	AASHO Designation: T 89-60
Determining the plastic limit of soils	AASHO Designation: T 90-56
Calculating the plasticity index of soils	AASHO Designation: T 91-54

Specific Gravity

Specific gravity of soils Modified as follows: 500 ML Pycnometer	AASHO Designation: T 100-60

Expansion and CBR Tests

Expansion test and California Bearing Ratio (CBR)	Section VIII - TM 5-530 "Materials Testing" by Headquarters, Dept. of the Army

Compaction Test

Moisture-Density relations of soils using a 10# rammer and an 18" drop	AASHO Designation: T 180-57

Unified Soil Classification

Designation E-3 from "Earth Manual" by the United States Department of the Interior Bureau of Reclamation

GENERAL TESTING METHODS

Consolidation Test

Chapter IX
"Soil Testing for Engineers"
by T. William Lambe
The Massachusetts Institute
of Technology

Laboratory Shear Test

Laboratory shear test using the Torvane

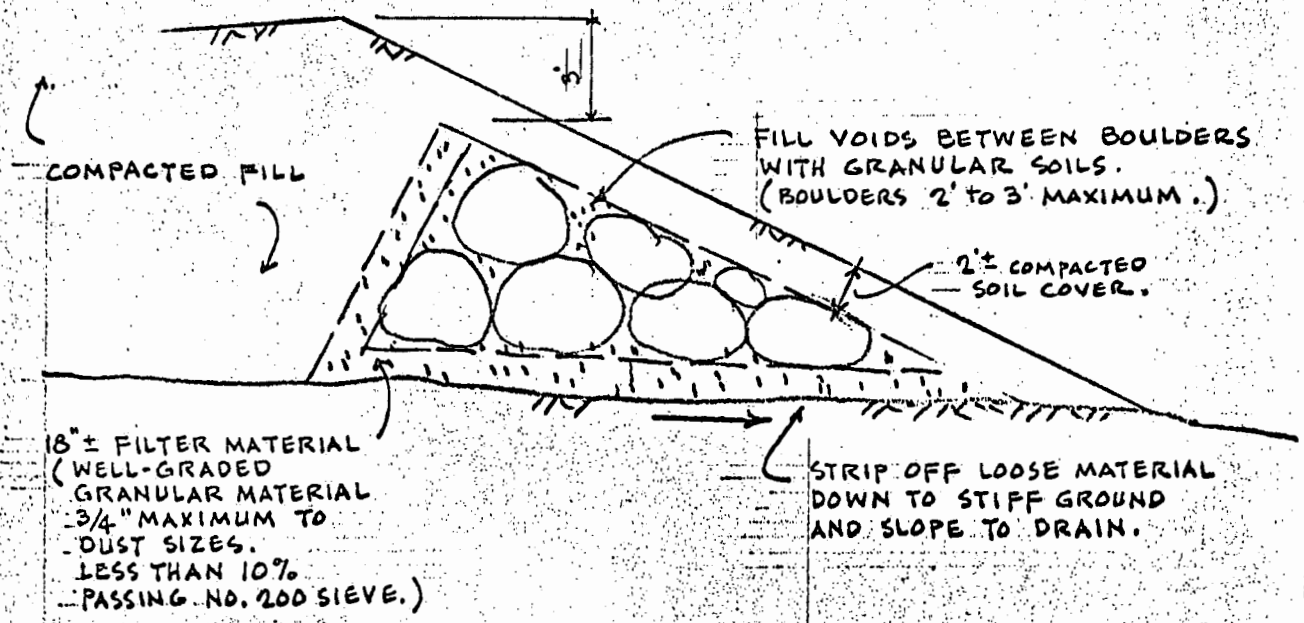
Brochure by Soiltest, Inc.

LIMITATIONS

In general, soil formations are commonly erratic and rarely uniform or regular. The boring logs indicate the approximate subsurface soil conditions encountered only at the drill holes where the borings were made at the times designated on the logs and may not represent conditions at other locations or at other dates. Soil conditions and water levels may change with the passage of time and construction methods or improvements at the site.

During construction, should subsurface conditions much different from those in the borings be observed, encountered, or otherwise indicated, we should be advised immediately to review or reconsider our recommendations in light of the new developments.

Our professional services were performed, findings obtained and recommendations prepared in accordance with generally accepted engineering practices. This warranty is in lieu of all other warranties expressed or implied.



SECTION

NOT TO SCALE

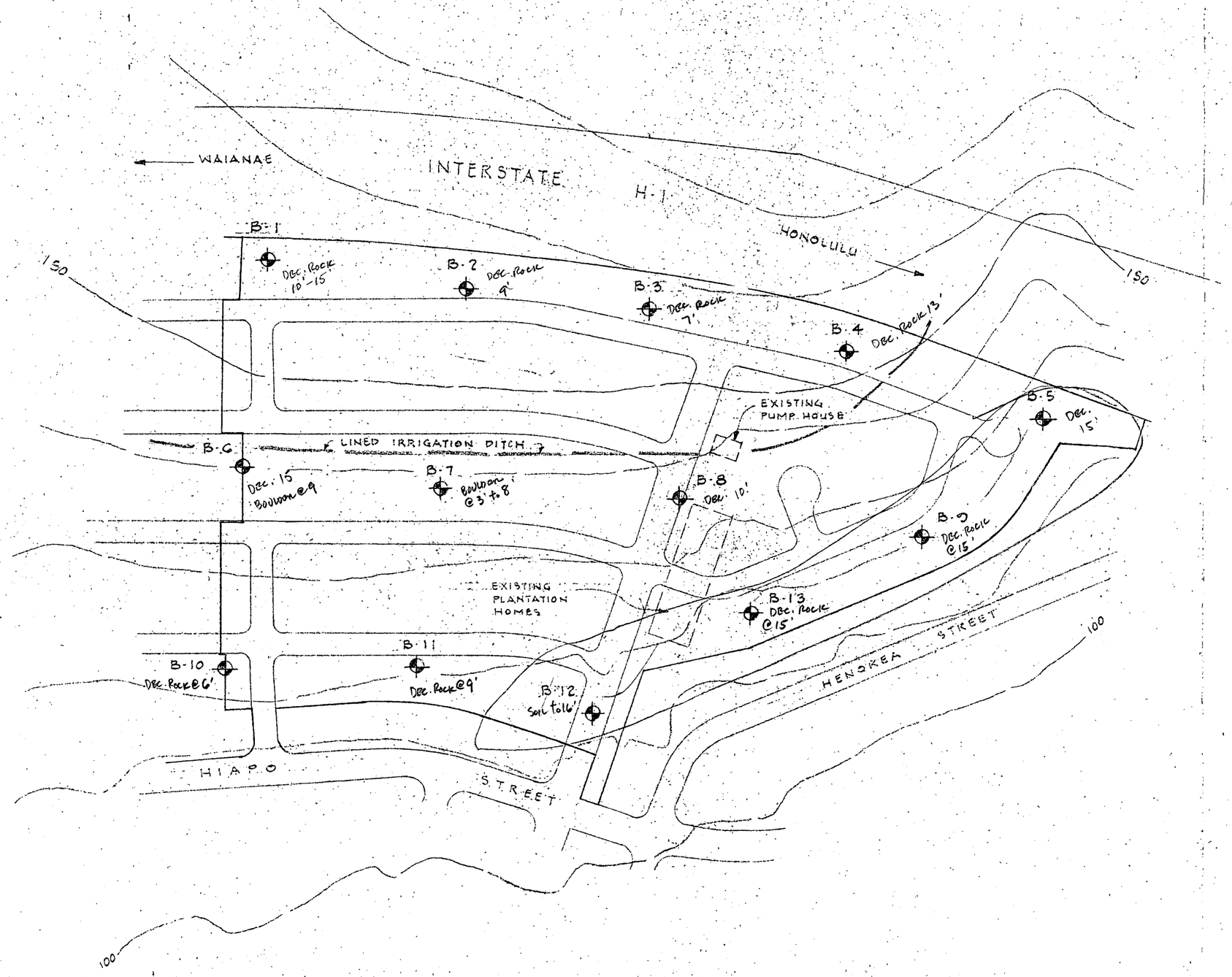
FIGURE 1

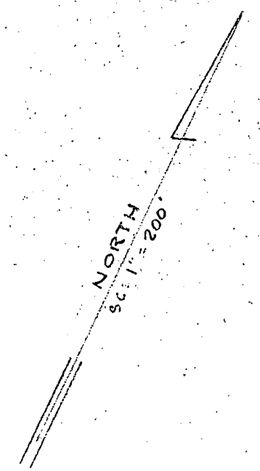
PROPOSED BOULDER FILL

WAIPAHU ESTATES UNIT 3-1

WAIPIO, EWA, OAHU, HAWAII

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS





BORING LOCATION PLAN
WAIPAHU ESTATES UNIT 3-1

WAIPIO, OAHU, HAWAII
TAX MAP KEY: 9-4-07: 11 & 24

Dr. EH	WALTER LUM ASSOCIATES, INC.	Sheet
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